method is disclosed for moving a logical entity, wherein the logical entity is capable of being accessed by a plurality of host computers without having to freeze access to the logical entity. The Office Action is incorrect in characterizing this portion of the disclosure as an admission of prior art, as the cited passage describes aspects of embodiments of the Applicant's invention.

The cited passage describes aspects of an embodiment of the Applicant's invention wherein all I/O directed to a logical entity is frozen during its migration. The cited passage states that FIG. 19 and the related discussion is directed to one embodiment of the present invention. The specification explicitly recites on page 39 lines 10-12: "*in this embodiment*, when the copy of the logical entity is created in step 191, there is no fear updates being made to the logical entity at the old location that would not be reflected where the copy is being created." The specification also recites at lines 16-19: "similarly, if only one host may access the logical entity and the ELVID update can be synchronized with the I/O stream, a logical entity can be moved according to FIG. 19, without having to freeze access to the logical entity." The cited passage discloses aspects of embodiments of the invention wherein a logical entity may be frozen, or not frozen, during a migration thereof. The cited passage does not disclose the prior art, as alleged.

In summary, the cited passage forms a portion of the Applicant's disclosure of the invention, and therefore is not proper prior art that can be combined with other references to support a rejection under 35 U.S.C. §103(a). Thus, the combination is improper, and the rejection under 35 U.S.C. §103(a) should be withdrawn.

2. Even if the asserted combination were proper, claims 1-30 are not obvious in view of the cited references.

A. Claims 1-15

Claim 1 recites a method of moving a logical entity from a first storage element to a second storage element, the logical entity being capable of being accessed by a plurality of host computers. The method comprises steps of creating a copy of the logical entity on the second storage element, moving all reads of the logical entity from each of the host computers to the second storage element, and, after the step of moving all reads, moving all writes to the logical entity to the second storage element.

In paragraph 3, the Office Action asserts that the alleged AAPA discloses a method of moving a logical entity, wherein the logical entity is capable of being accessed by a plurality of host computers without having to freeze access to the logical entity, and that McBrearty teaches a method of moving a logical entity from a first to a second storage element including creating a copy of the entity on the second storage element and moving all of the reads of the logical entity from each of the first storage elements to the second storage element. In paragraph 5, the Office Action further asserts that it would have been obvious to one of ordinary skill in the art to "combine McBrearty's method of first moving all read operations and then moving all updated write operations to the second storage element with the prior art system," because doing so "would allow data to be independently manipulated without causing interference with production processing, thereby reducing the system resources required to backup and restore original data." The Applicant respectfully disagrees, for at least three reasons.

First, McBrearty teaches a method whereby read operations are redirected only after write operations are completed, and thus operates in a manner opposite to the method of claim 1. McBrearty provides a single backup copy for a series of mirrored volumes that remains unchanged during I/O operations (col. 4, lines 31-32), but which maintains a record of all writes performed to data blocks on the mirrored volumes by marking the blocks "stale" (col. 6, lines 39-40). Each time a read operation is directed to a block on one of the mirrored volumes, the considered block is checked to see if it is stale (col. 6, lines 52-53). If it is stale, the operation is redirected according to a selection process (col. 5, lines 55-57) to another volume on which the block is not stale (col. 6, line 1 et seq., col. 7, lines 1-45). Unlike the method of claim 1, wherein write operations are moved only after read operations have been moved, McBrearty teaches read operations that are moved only after write operations have been performed. In this respect, McBrearty teaches away from the method of claim 1. Thus, claim 1 is not obvious in view of the asserted combination.

Second, McBrearty teaches a method whereby a user directs an I/O operation to one of two entry points, and thus does not teach a method whereby all reads of a logical entity are moved from a first storage element to a second storage element, after which all writes to the logical entity are moved from the first storage element to the second storage element, as recited in claim 1. McBrearty teaches a method whereby testing may be performed on one or more of

the mirrored volumes while normal processing continues on the backup copy (col. 3, lines 1-4). McBrearty teaches that two entry points are established to allow access to either the mirrored volume(s) or the backup (col. 4, lines 55-56), and that a user chooses the entry point to which the operation is to be directed (col. 5, lines 47-51). Thus, McBrearty teaches a method whereby an I/O operation is directed, at the user's discretion, toward either a mirrored volume or to a backup copy. As a result, McBrearty does not teach a method whereby all reads are moved from a first storage element to a second storage element, and then all writes are moved from the first storage element to the second storage element, because the purpose of McBreary is to continue to read and write to both the mirrored volume and the backup volume via the two entry points. Indeed, McBrearty does not teach that all operations of either type are moved, let alone in the sequence recited in claim 1. Thus, claim 1 is not obvious in view of the asserted combination.

Third, although McBrearty teaches that once a user selects an entry point, an I/O operation may be redirected to any of a group of mirrored volumes (col. 6, line 1 et seq., col. 7, lines 1-45), this redirection is performed arbitrarily. Specifically, McBrearty teaches that the redirection may be to any mirrored volume on which the considered block is not marked stale. McBrearty teaches that once a list of "valid mirrors" is established via the selection process (i.e., a list of mirrors on which the considered data block is not stale), the I/O operation "picks from the list of valid mirrors and starts the read/write to the selected logical volume mirror" (col. 5, lines 55-63). Therefore, McBrearty does not teach a process wherein all read operations are moved from a first storage element to a second storage element, as recited in claim 1. As a result, claim 1 is not obvious in view of the asserted combination.

For each of the reasons discussed above, claim 1 patentably distinguishes over the asserted combination, and the rejection of claim 1 under 35 U.S.C. §103(a) as being obvious over the alleged AAPA in view of McBrearty should be withdrawn.

Claims 2-15 depend from claim 1, and are patentable for at least the same reasons.

B. Claims 16-19

Claim 16 recites a host computer comprising a processing unit and a memory interface module to permit access to a logical entity to be made to one physical storage location for a read request and to a different physical storage location for a write request.

In paragraph 6, the Office Action asserts that the combination of the alleged AAPA and McBrearty teaches a host computer comprising a processing unit, and a memory interface module to permit access to a logical entity to be made to one physical storage location for a read request, and to a different physical storage location for a write request. The Office Action refers to Logical Volume Memory (LVM) 30 in FIG. 1 of McBrearty to support this rejection, but fails to identify how this feature meets the specific limitations of claim 16. Therefore, the Office Action fails to explain and support the rejection, as required by 37 CFR 1.104(c)(2) and MPEP §706.02(j). As such, the rejection of claim 16 under 35 U.S.C. §103(a) is improper and should be withdrawn.

Further, claim 16 is not rendered obvious by the asserted combination. In particular, McBrearty does not teach or suggest a module to permit accesses to a logical entity to be made at one physical storage location for a read request, and to a different physical storage location for a write request, as recited in claim 16. McBrearty teaches a system supervisory call (SVC) handler in memory which enables an entry point to be selected (col. 5, lines 24-29), and which allows an I/O operation to be distributed to any of a series of mirrored logical volumes according to a selection process (col. 5, lines 55-57). McBrearty describes the redirection of both read operations (col. 6, lines 50-51) and write operations (col. 7, line 15). McBrearty does not disclose a feature which permits access to a logical entity at one physical location for a read request, and at another location for a write request. Therefore, claim 16 patentably distinguishes over the cited references, and the rejection of claim 16 under 35 U.S.C. §103 should be withdrawn.

Claims 17-19 depend from claim 16 and are allowable for the same reasons.

C. Claims 20-22

Claim 20 recites a storage management controller for a computer storage system that includes a plurality of storage elements. The storage management controller comprises an interface module to communicate with the storage elements, and an entity movement manager to control separate moving of a read location and a write location for a specified logical entity.

As discussed above with respect to independent claim 16, McBrearty does not disclose or suggest a feature to permit access to a logical entity at one physical location for a read request,

and to a different physical location for a write request. As discussed above with respect to claim 1, McBrearty discloses allowing I/O operations, including both reads and writes, to be performed either on a backup copy, or on one of a series of mirrored volumes, depending on an entry point chosen by a user. McBrearty specifically teaches that read and/or write operations may be performed on each (col. 6, lines 1-67 and col. 7, lines 1-46). McBrearty does not "control separate moving of a read location and a write location for a specified logical entity," because McBrearty does not teach a read location and a write location for a specified logical entity. Therefore, McBrearty does not disclose or suggest an entity movement manager to control separate moving of a read location and a write location for a specified logical entity, as recited in claim 20. Accordingly, claim 20 patentably distinguishes over the cited references, and the rejection of claim 20 under 35 U.S.C. §103(a) should be withdrawn.

Claims 21 and 22 depend from claim 20 and are patentable for at least the same reasons.

D. Claims 23-30

Claim 23 recites a computer system comprising a plurality of host computers, a plurality of storage elements, and means for separately moving reads for a logical entity and writes for the logical entity from a first physical storage location on one of the storage elements to a second physical storage location on a different one of the storage elements.

As discussed above with respect to independent claim 16, McBrearty discloses an SVC handler which enables a user to select an entry point in order to direct I/O operations, which may then be further redirected according to a selection process. McBrearty does not disclose directing reads of a logical entity to one physical location, and writes to the entity to a second physical location. Thus, McBrearty does not disclose means for separately moving reads for a logical entity and writes for the logical entity from a first physical storage location on one of the storage elements to a second physical storage location on a different one of the storage elements. Accordingly, claim 23 patentably distinguishes over the cited references, and the rejection of claim 23 under 35 U.S.C. §103(a) should be withdrawn.

Claims 24-30 depend from claim 23 and are patentable for at least the same reasons.

Amended Claim 4

Claim 4 has been amended to recite "during the step of moving all reads, passing all reads made to the logical entity at the first storage element to the copy on the second storage element." This amendment is made to correct a typographical error, changing the terms "writes" to - - reads - - to be consistent with claim 1. As amended, claim 4 should be in allowable condition.

CONCLUSION

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,
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x06/14/03x

MARKED-UP CLAIMS

Claims 4 and 7 have been amended as follows:

4. The method of claim 1, further comprising a step of:

during the step of moving all reads, passing all [writes] reads made to the logical entity at the first storage element to the copy on the second storage element.

7. The method of claim 6, further comprising a step of determining an enterprise logical volume identifier (ELVID) for the logical volume.